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09/578,095	05/25/2000	James Kenneth Aragones	RD-27,376	6313

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EXAMINER

THANGAVELU, KANDASAMY

ART UNIT PAPER NUMBER

2123

DATE MAILED: 09/25/2003

3

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application N .

09/578,095

Applicant(s)

ARAGONES ET AL.

Examiner

Kandasamy Thangavelu

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 25 May 2000.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-81 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-81 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 25 May 2000 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- |                                                                                                              |                                                                             |
|--------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                  | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____  |
| 2) <input checked="" type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)              | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>2</u> . | 6) <input type="checkbox"/> Other: _____                                    |

## **DETAILED ACTION**

### ***Introduction***

1. Claims 1-81 of the application have been examined.

### ***Information Disclosure Statement***

2. Acknowledgment is made of the information disclosure statements filed on May 25, 2000 together with copies of the papers. The papers have been considered in reviewing the claims.

### ***Drawings***

3. The draft person has objected to the drawings; see a copy of Form PTO-948 for an explanation.

### ***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

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5. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. Claims 1-3, 5-8, 22, 23, 25-28, 42, 43, 45-48, 62, 63 and 65-68 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Kaminskiy et al. (KA)** ("A Monte Carlo approach to Warranty Repair predictions", SAE International, 1997) in view of **Cribbes (CR)** ("Changes in Engine maintenance management", Aerospace Engineering, December 1997), and further in view of **Endrenyi et al. (EN)** (IEEE, 1997).

6.1 **KA** teaches a Monte Carlo approach to Warranty Repair predictions. Specifically, as per Claim 1, **KA** teaches a system for predicting the timing of a future service event of a product formed from a plurality of compartments (Pg 1, Abstract; Pg 2, CL2, Para 3 & 4); comprising:  
a simulator for simulating a distribution of future service events of the product according to the plurality of compartment failure information and the performance deterioration rate analysis (Pg 1, Abstract; Pg 1, CL1, Para 3; Pg 2, CL2, Para 3 & 4; Pg 3, CL2, Para 2; Fig. 5).

**KA** does not expressly teach a database that contains a plurality of service information and a plurality of performance information for the product. **CR** teaches a database that contains a plurality of service information (Pg 9, CL1, Para 2 & 3) and a plurality of performance

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information for the product (Pg 9, CL1, Para 4), as the performance information indicates specific deterioration and the service information and the performance information will identify the likely maintenance actions required at the next shop visit (Pg 9, CL1, Para 3) so the maintenance shop can develop proper maintenance process (Pg 9, CL1, Para 4). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the system of **KA** with the system of **CR** that included a database that contained a plurality of service information and a plurality of performance information for the product, as the performance information would indicate specific deterioration and the service information and the performance information would identify the likely maintenance actions required at the next shop visit so the maintenance shop could develop proper maintenance process.

**KA** does not expressly teach a statistical analyzer that analyzes the plurality of service information to determine a plurality of compartment failure information. **EN** teaches a statistical analyzer that analyzes the plurality of service information to determine a plurality of compartment failure information (Pg 576, CL2, Para 2 & 5; Pg 578, CL1, Para 4 & 5; Fig. 2; Pg 579, CL2, Para 5; Fig. 6), as the compartment failure information can be used to determine means, variances and the probability distributions of times to failures of the compartments (Pg 578, CL1, Para 4 & 5). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the system of **KA** with the system of **EN** that included a statistical analyzer that analyzes the plurality of service information to determine a plurality of compartment failure information, as the compartment failure information could be used to determine means, variances and the probability distributions of times to failures of the compartments.

**KA** does not expressly teach a performance deterioration rate analyzer that analyzes performance deterioration rate of the product from the plurality of service information and performance information. **CR** teaches a performance deterioration rate analyzer that analyzes performance deterioration rate of the product from the plurality of service information and performance information (Pg 9, CL1, Para 3 & 4), as the performance deterioration rate information identifies the likely maintenance actions required at the next shop visit (Pg 9, CL1, Para 3), so the maintenance shop could develop proper maintenance process (Page 9, CL1, Para 4). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the system of **KA** with the system of **CR** that included a performance deterioration rate analyzer that analyzes performance deterioration rate of the product from the plurality of service information and performance information, as the performance deterioration rate information would identify the likely maintenance actions required at the next shop visit so the maintenance shop could develop proper maintenance process.

#### Dependent claims

Per Claim 2: **KA**, **CR** and **EN** teach the system of Claim 1. **KA** does not expressly teach that the database comprises a service database and a performance historical database. **CR** teaches that the database comprises a service database and a performance historical database (Pg 9, CL1, Para 2 & 3), as the performance information indicates specific deterioration and the service information and the performance information will identify the likely maintenance actions required at the next shop visit (Pg 9, CL1, Para 3) so the maintenance shop can develop proper maintenance process (Pg 9, CL1, Para 4). It would have been obvious to one of ordinary skill in

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the art at the time of Applicants' invention to modify the system of **KA** with the system of **CR** that included the database comprising a service database and a performance historical database, as the performance information would indicate specific deterioration and the service information and the performance information would identify the likely maintenance actions required at the next shop visit so the maintenance shop could develop proper maintenance process.

Per Claim 3: **KA**, **CR** and **EN** teach the system of Claim 1. **KA** does not expressly teach that the plurality of service information comprises compartment definitions, repair history and service factors. **CR** teaches that the plurality of service information comprises compartment definitions, repair history and service factors (Pg 9, CL1, Para 2 & 3), as the service information will identify the likely maintenance actions required at the next shop visit, so suitable preparations can be made before the product arrives for repair and maintenance (Pg 9, CL1, Para 3). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the system of **KA** with the system of **CR** that included the plurality of service information comprising compartment definitions, repair history and service factors, as the service information would identify the likely maintenance actions required at the next shop visit, so suitable preparations could be made before the product arrives for repair and maintenance.

Per Claim 5: **KA**, **CR** and **EN** teach the system of Claim 1. **KA** does not expressly teach system further comprising a preprocessor for processing the plurality of service information into a predetermined format. **EN** teaches system further comprising a preprocessor for processing the

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plurality of service information into a predetermined format (Fig. 3), as the service information can be used to obtain the compartment failure information (Fig. 2) and compartment failure information can be used to determine means, variances and the probability distributions of times to failures of the compartments (Pg 578, CL1, Para 4 & 5). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the system of **KA** with the system of **EN** that included system further comprising a preprocessor for processing the plurality of service information into a predetermined format, as the service information could be used to obtain the compartment failure information and the compartment failure information could be used to determine means, variances and the probability distributions of times to failures of the compartments.

Per Claim 6: **KA**, **CR** and **EN** teach the system of Claim 1. **KA** does not expressly teach that the preprocessor generates a plurality of data files according to the plurality of service information. **EN** teaches that the preprocessor generates a plurality of data files according to the plurality of service information (Fig. 2), as the information can be used to predict the mean and distribution of the remaining life to failure for any stage of aging (Pg 576, Abstract). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the system of **KA** with the system of **EN** that included the preprocessor generating a plurality of data files according to the plurality of service information, as the information could be used to predict the mean and distribution of the remaining life to failure for any stage of aging.



Per Claim 7: **KA**, **CR** and **EN** teach the system of Claim 1. **KA** does not expressly teach that the plurality of compartment failure information comprises compartment failure variables and compartment time-to-failure coefficients. **EN** teaches that the plurality of compartment failure information comprises compartment failure variables and compartment time-to-failure coefficients (Pg 578, CL2, Para 3 to Pg 579, CL1, Para 3; Fig. 6), as the information can be used to obtain the failure information for the entire system and the cost incurred due to component failures (Pg 581, CL2, Para 2); and a mathematical model can be constructed linking failures and maintenance modes and used to compute costs of alternative maintenance schedules (Pg 581, CL2, Para 3). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the system of **KA** with the system of **EN** that included that the plurality of compartment failure information comprising compartment failure variables and compartment time-to-failure coefficients, as the information could be used to obtain the failure information for the entire system and the cost incurred due to component failures and a mathematical model could be constructed linking failures and maintenance modes and used to compute costs of alternative maintenance schedules.

Per Claim 8: **KA**, **CR** and **EN** teach the system of Claim 7. **KA** does not expressly teach that the statistical analyzer uses the plurality of compartment failure information to determine which compartment failure variables influence the timing of future service events and estimate time-to-failure distributions for the plurality of compartments. **EN** teaches that the statistical analyzer uses the plurality of compartment failure information to determine which compartment failure variables influence the timing of future service events and estimate time-to-failure

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distributions for the plurality of compartments (Fig3; Pg 578, CL2, Para 3 to Pg 579, CL1, Para 3; Fig. 2; Fig. 6), as the information can be used to obtain the failure information for the entire system and the cost incurred due to component failures (Pg 581, CL2, Para 2); and a mathematical model can be constructed linking failures and maintenance modes and used to compute costs of alternative maintenance schedules (Pg 581, CL2, Para 3). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the system of **KA** with the system of **EN** that included the statistical analyzer using the plurality of compartment failure information to determine which compartment failure variables influence the timing of future service events and estimate time-to-failure distributions for the plurality of compartments, as the information could be used to obtain the failure information for the entire system and the cost incurred due to component failures and a mathematical model could be constructed linking failures and maintenance modes and used to compute costs of alternative maintenance schedules.

6.2 As per Claims 22, 23, 25-28, 42, 43, 45-48, 62, 63 and 65-68, these are rejected based on the same reasoning as Claims 1, 3, and 5-8, supra. Claims 22, 23, 25-28, 42, 43, 45-48, 62, 63 and 65-68 are system, method and computer readable medium claims reciting the same limitations as Claims 1, 3, and 5-8, as taught throughout by **KA**, **CR** and **EN**.

7. Claims 4, 21, 24, 41, 44, 61, 64 and 81 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Kaminskiy et al. (KA)** ("A Monte Carlo approach to Warranty Repair predictions", SAE International, 1997) in view of **Cribbes (CR)** ("Changes in Engine

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maintenance management”, Aerospace Engineering, December 1997), and further in view of **Endrenyi et al. (EN)** (IEEE, 1997) and **Aerospace Technology (AT)** (“Forecasting engine removals and shop visits”, Aircraft Technology Engineering & maintenance, 1996-1997).

7.1 As per Claim 4, **KA**, **CR** and **EN** teach the system of Claim 1. **KA**, **CR** and **EN** do not expressly teach that the plurality of performance information comprises performance characteristic values, initial data levels after servicing, current data levels. **AT** teaches that the plurality of performance information comprises performance characteristic values, initial data levels after servicing, current data levels (Pg 3, CL1, Para 1 & 3; Pg 4, CL1, Para 2; Pg. 4, CL2, Para 1), as the information can be used to forecast product removal rates to construct a plan for incoming product volumes; and the forecast can be used for maintenance cost planning yielding requirements for material and manpower for maintenance (Pg 3, CL1, Para 2). It would have been obvious to one of ordinary skill in the art at the time of Applicants’ invention to modify the system of **KA**, **CR** and **EN** with the system of **AT** that included the plurality of performance information comprising performance characteristic values, initial data levels after servicing, current data levels, as the information could be used to forecast product removal rates to construct a plan for incoming product volumes; and the forecast could be used for maintenance cost planning yielding requirements for material and manpower for maintenance.

**KA**, **EN** and **AT** do not expressly teach that the plurality of performance information comprises dates at which the product is serviced, and variables that affect the servicing of a subset of the plurality of compartments. **CR** teaches that the plurality of performance information comprises dates at which the product is serviced, and variables that affect the

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servicing of a subset of the plurality of compartments (Pg 9, CL1, Para 3 to 6), as the performance information will identify the likely maintenance actions required at the next shop visit (Pg 9, CL1, Para 3) so the maintenance shop can develop proper maintenance process (Pg 9, CL1, Para 4). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the system of **KA**, **EN** and **AT** with the system of **CR** that included the plurality of performance information comprising dates at which the product would be serviced, and variables that affect the servicing of a subset of the plurality of compartments, as the performance information would identify the likely maintenance actions required at the next shop visit so the maintenance shop could develop proper maintenance process.

Per Claim 21: **KA**, **CR** and **EN** teach the system of Claim 1. **KA** does not expressly teach that the simulator forecasts a service plan for the future service events that comprises the time for scheduling the service events. **AT** teaches that the simulator forecasts a service plan for the future service events that comprises the time for scheduling the service events (Pg 3, CL1, Para 2; Pg 4, CL1, Para 2; Pg.4, CL2, Para 1), as the forecast can be used for maintenance cost planning yielding requirements for material and manpower for maintenance (Pg 3, CL1, Para 2). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the system of **KA** with the system of **AT** that included that the simulator forecast a service plan for the future service events that comprised the time for scheduling the service events, as the forecast could be used for maintenance cost planning yielding requirements for material and manpower for maintenance.

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7.2 As per Claims 24, 41, 44, 61, 64 and 81, these are rejected based on the same reasoning as Claims 4 and 21, supra. Claims 24, 41, 44, 61, 64 and 81 are system, method and computer readable medium claims reciting the same limitations as Claims 4 and 21, as taught throughout by **KA**, **CR**, **EN** and **AT**.

8. Claims 9, 29, 49 and 69 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Kaminskiy et al. (KA)** ("A Monte Carlo approach to Warranty Repair predictions", SAE International, 1997) in view of **Cribbes (CR)** ("Changes in Engine maintenance management", Aerospace Engineering, December 1997), and further in view of **Endrenyi et al. (EN)** (IEEE, 1997) and **Woodman et al. (WO)** (U.S. Patent 6,195,624).

8.1 As per Claim 9, **KA**, **CR** and **EN** teach the system of Claim 8. **KA**, **CR** and **EN** do not expressly teach that the statistical analyzer uses the estimated time-to-failure distributions to determine a Weibull distribution for a subset of the plurality of compartments defined for the product. **WO** teaches that the statistical analyzer uses the estimated time-to-failure distributions to determine a Weibull distribution for a subset of the plurality of compartments defined for the product (CL6, L30-56), as the Weibull model uses shape and scale parameters which have physical significance; the scale parameter indicates the time at which 63% of the population have failed; and the shape parameter indicates the rate at which the failures increase (CL6, L48-56). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the system of **KA**, **CR** and **EN** with the system of **WO** that included the statistical analyzer using the estimated time-to-failure distributions to determine a Weibull distribution for

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a subset of the plurality of compartments defined for the product, as the Weibull model uses shape and scale parameters which have physical significance; the scale parameter indicates the time at which 63% of the population have failed; and the shape parameter indicates the rate at which the failures increase.

8.2 As per Claims 29, 49 and 69, these are rejected based on the same reasoning as Claim 9, supra. Claims 29, 49 and 69 are system, method and computer readable medium claims reciting the same limitations as Claim 9, as taught throughout by **KA**, **CR**, **EN** and **WO**.

9. Claims 10, 30, 50 and 70 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Kaminskiy et al. (KA)** ("A Monte Carlo approach to Warranty Repair predictions", SAE International, 1997) in view of **Cribbes (CR)** ("Changes in Engine maintenance management", Aerospace Engineering, December 1997), and further in view of **Endrenyi et al. (EN)** (IEEE, 1997) and **Subramanyam (SU)** (U.S. Patent 5,701,471).

9.1 As per Claim 10, **KA**, **CR** and **EN** teach the system of Claim 1. **KA**, **CR** and **EN** do not expressly teach that the statistical analyzer comprises a service analysis script that executes a plurality of statistical procedures. **SU** teaches that the statistical analyzer comprises a service analysis script that executes a plurality of statistical procedures (Abstract; Fig. 1, BLK 116 and 120; Fig. 2; CL2, L25-43), as the scripts specify the operations to be performed and the performance statistics to be collected (CL2, L25-29). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the system of **KA**, **CR** and

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**EN** with the system of **SU** that included the statistical analyzer comprising a service analysis script that executed a plurality of statistical procedures, as the scripts would specify the operations to be performed and the performance statistics to be collected.

9.2 As per Claims 30, 50 and 70, these are rejected based on the same reasoning as Claim 10, supra. Claims 30, 50 and 70 are system, method and computer readable medium claims reciting the same limitations as Claim 10, as taught throughout by **KA**, **CR**, **EN** and **SU**.

10. Claims 11, 31, 51 and 71 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Kaminskiy et al. (KA)** ("A Monte Carlo approach to Warranty Repair predictions", SAE International, 1997) in view of **Cribbes (CR)** ("Changes in Engine maintenance management", Aerospace Engineering, December 1997), and further in view of **Endrenyi et al. (EN)** (IEEE, 1997), **Subramanyam (SU)** (U.S. Patent 5,701,471) and **Djaja et al. (DJ)** (U.S. Patent 6,405,160).

10.1 As per Claim 11, **KA**, **CR**, **EN** and **SU** teach the system of Claim 10. **KA**, **CR**, **EN** and **SU** do not expressly teach that the plurality of statistical procedures comprise a multivariate regression and/or a correlation analysis. **DJ** teaches that the plurality of statistical procedures comprise a multivariate regression and/or a correlation analysis (CL5, L52-59), as in the multivariate regression analysis, the changes in independent variables that correlate highly with dependent variables are allowed to remain in the modeling equation (CL2, L25-29). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to

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modify the system of **KA, CR, EN** and **SU** with the system of **DJ** that included the plurality of statistical procedures comprising a multivariate regression and/or a correlation analysis, as in the multivariate regression analysis, the changes in independent variables that correlate highly with dependent variables would be allowed to remain in the modeling equation.

10.2 As per Claims 31, 51 and 71, these are rejected based on the same reasoning as Claim 11, supra. Claims 31, 51 and 71 are system, method and computer readable medium claims reciting the same limitations as Claim 11, as taught throughout by **KA, CR, EN, SU** and **DJ**.

11. Claims 12, 32, 52 and 72 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Kaminskiy et al. (KA)** (“A Monte Carlo approach to Warranty Repair predictions”, SAE International, 1997) in view of **Cribbes (CR)** (“Changes in Engine maintenance management”, Aerospace Engineering, December 1997), and further in view of **Endrenyi et al. (EN)** (IEEE, 1997), **Subramanyam (SU)** (U.S. Patent 5,701,471) and **Cave et al. (CA)** (U.S. Patent 5,740,233).

11.1 As per Claim 12, **KA, CR, EN** and **SU** teach the system of Claim 10. **KA, CR, EN** and **SU** do not expressly teach that the service analysis script generates a plurality of statistical diagnostic information. **CA** teaches that the service analysis script generates a plurality of statistical diagnostic information (CL3, L27-30; CL3, L55-64), as changes in the statistical diagnostic information could be used to identify faults and alert the personnel, when they fall outside set thresholds (CL4, L9-15). It would have been obvious to one of ordinary skill in the



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art at the time of Applicants' invention to modify the system of **KA, CR, EN** and **SU** with the system of **CA** that included the service analysis script generating a plurality of statistical diagnostic information, as changes in the statistical diagnostic information could be used to identify faults and alert the personnel, when they fell outside set thresholds.

11.2 As per Claims 32, 52 and 72, these are rejected based on the same reasoning as Claim 12, supra. Claims 32, 52 and 72 are system, method and computer readable medium claims reciting the same limitations as Claim 12, as taught throughout by **KA, CR, EN, SU** and **CA**.

12. Claims 13, 33, 53 and 73 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Kaminskiy et al. (KA)** ("A Monte Carlo approach to Warranty Repair predictions", SAE International, 1997) in view of **Cribbes (CR)** ("Changes in Engine maintenance management", Aerospace Engineering, December 1997), and further in view of **Endrenyi et al. (EN)** (IEEE, 1997), **Subramanyam (SU)** (U.S. Patent 5,701,471), **Cave et al. (CA)** (U.S. Patent 5,740,233), **Stoughton et al. (ST)** (U.S. Patent 6,132,969) and **Baleanu (BA)** (U.S. Patent 5,748,508).

12.1 As per Claim 13, **KA, CR, EN, SU** and **CA** teach the system of Claim 12. **KA, CR, EN, SU** and **CA** do not expressly teach that the plurality of statistical diagnostic information comprises goodness-of-fit metrics and collinearity diagnostics. **ST** teaches that the plurality of statistical diagnostic information comprises goodness-of-fit metrics (Abstract; CL3, L26-52; CL3, L55-64), as goodness-of-fit measures how well a given model represents the underlying data (CL3, L26-28). It would have been obvious to one of ordinary skill in the art at the time of

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Applicants' invention to modify the system of **KA, CR, EN, SU** and **CA** with the system of **ST** that included the plurality of statistical diagnostic information comprising goodness-of-fit metrics, as goodness-of-fit would measure how well a given model represents the underlying data.

**KA, CR, EN, SU, CA** and **ST** do not expressly teach that the plurality of statistical diagnostic information comprises collinearity diagnostics. **BA** teaches that the plurality of statistical diagnostic information comprises collinearity diagnostics (Abstract), as collinearity measures is used to identify collinearity free regression models to best model and control a process (Abstract). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the system of **KA, CR, EN, SU, CA** and **ST** with the system of **BA** that included the plurality of statistical diagnostic information comprising collinearity diagnostics, as collinearity measures would be used to identify collinearity free regression models to best model and control a process.

12.2 As per Claims 33, 53 and 73, these are rejected based on the same reasoning as Claim 13, supra. Claims 33, 53 and 73 are system, method and computer readable medium claims reciting the same limitations as Claim 13, as taught throughout by **KA, CR, EN, SU, CA, ST** and **BA**.

13. Claims 14, 34, 54 and 74 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Kaminskiy et al. (KA)** ("A Monte Carlo approach to Warranty Repair predictions", SAE International, 1997) in view of **Cribbes (CR)** ("Changes in Engine maintenance management", Aerospace Engineering, December 1997), and further in view of **Endrenyi et al. (EN)** (IEEE,

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1997), **Subramanyam (SU)** (U.S. Patent 5,701,471) and **Meester et al. (ME)** (U.S. Patent 5,686,359).

13.1 As per Claim 14, **KA, CR, EN** and **SU** teach the system of Claim 12. **KA, CR, EN** and **SU** do not expressly teach that the service analysis script generates a plurality of residual plots. **ME** teaches that the service analysis script generates a plurality of residual plots (CL4, L52-56), as the residual plots indicate the lack of inadequacy of the models (CL3, L26-28). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the system of **KA, CR, EN** and **SU** with the system of **ME** that included the service analysis script generating a plurality of residual plots, as the residual plots would indicate the lack of inadequacy of the models.

13.2 As per Claims 34, 54 and 74, these are rejected based on the same reasoning as Claim 14, supra. Claims 34, 54 and 74 are system, method and computer readable medium claims reciting the same limitations as Claim 14, as taught throughout by **KA, CR, EN, SU** and **ME**.

14. Claims 15, 16, 35, 36, 55, 56, 75 and 76 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Kaminskiy et al. (KA)** ("A Monte Carlo approach to Warranty Repair predictions", SAE International, 1997) in view of **Cribbes (CR)** ("Changes in Engine maintenance management", Aerospace Engineering, December 1997), and further in view of **Endrenyi et al. (EN)** (IEEE, 1997), and **Kozam et al. (KO)** (U.S. Patent application 2002/0035570).

14.1 As per Claim 15, **KA**, **CR** and **EN** teach the system of Claim 1. **KA**, **CR** and **EN** do not expressly teach that the statistical analyzer comprises a validation script. **KO** teaches that the statistical analyzer comprises a validation script (Para 0008, Para 0029), as the validation script provides information necessary to check the data received as service and performance information against the data already in the database (Para 0033). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the system of **KA**, **CR** and **EN** with the system of **KO** that included the statistical analyzer comprising a validation script, as the validation script would provide information necessary to check the data received as service and performance information against the data already in the database.

Per Claim 16: **KA**, **CR** and **EN** do not expressly teach that the validation script is applied to a plurality of case studies set up for the product. **KO** teaches that the validation script is applied to a plurality of case studies set up for the product (Para 0008, Para 0029), as the validation script provides information necessary to check the data received as service and performance information against the data already in the database (Para 0033). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the system of **KA**, **CR** and **EN** with the system of **KO** that included the validation script being applied to a plurality of case studies set up for the product, as the validation script would provide information necessary to check the data received as service and performance information against the data already in the database.

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14.2 As per Claims 35, 36, 55, 56, 75 and 76, these are rejected based on the same reasoning as Claims 15 and 16, supra. Claims 35, 36, 55, 56, 75 and 76 are system, method and computer readable medium claims reciting the same limitations as Claims 15 and 16, as taught throughout by **KA**, **CR**, **EN** and **KO**.

15. Claims 17, 37, 57 and 77 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Kaminskiy et al. (KA)** (“A Monte Carlo approach to Warranty Repair predictions”, SAE International, 1997) in view of **Cribbes (CR)** (“Changes in Engine maintenance management”, Aerospace Engineering, December 1997), and further in view of **Endrenyi et al. (EN)** (IEEE, 1997), and **Butler (BU)** (“An expert system based Framework for an incipient failure detection and Preventive maintenance system, IEEE 1996).

15.1 As per Claim 17, **KA**, **CR** and **EN** teach the system of Claim 1. **KA**, **CR** and **EN** do not expressly teach that the performance deterioration rate analyzer comprises a statistical analysis script that relates a subset of compartments of the product according to time. **BU** teaches that the performance deterioration rate analyzer comprises a statistical analysis script that relates a subset of compartments of the product according to time (Pg 321, CL1, Para 5; Pg 321, CL2, Para 2; Pg 322, CL1, Para 3; Pg 321, CL2, Para 4 & 5), as the determination of the related times to failures of the compartments facilitates optimizing preventive maintenance program through system wide approach to predict equipment failures (Pg. 321, CL2, Para 2 & 3). It would have been obvious to one of ordinary skill in the art at the time of Applicants’ invention to modify the system of **KA**, **CR** and **EN** with the system of **BU** that included the performance deterioration rate analyzer

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comprising a statistical analysis script that relates a subset of compartments of the product according to time, as the determination of the related times to failures of the compartments would facilitate optimizing preventive maintenance program through system wide approach to predict equipment failures.

15.2 As per Claims 37, 57 and 77, these are rejected based on the same reasoning as Claim 17, supra. Claims 37, 57 and 77 are system, method and computer readable medium claims reciting the same limitations as Claim 17, as taught throughout by **KA**, **CR**, **EN** and **BU**.

16. Claims 18, 19, 38, 39, 58, 59, 78 and 79 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Kaminskiy et al. (KA)** ("A Monte Carlo approach to Warranty Repair predictions", SAE International, 1997) in view of **Cribbes (CR)** ("Changes in Engine maintenance management", Aerospace Engineering, December 1997), and further in view of **Endrenyi et al. (EN)** (IEEE, 1997), **Butler (BU)** ("An expert system based Framework for an incipient failure detection and Preventive maintenance system, IEEE 1996), and **Wang (WA)** (U.S. Patent 6,230,095).

16.1 As per Claim 18, **KA**, **CR**, **EN** and **BU** teach the system of Claim 17. **KA**, **CR**, **EN** and **BU** do not expressly teach that the statistical analysis script generates an estimated deterioration rate curve for the subset of compartments of the product. **WA** teaches that the statistical analysis script generates an estimated deterioration rate curve for the subset of compartments of the product (Abstract; CL2, L22-37), as the deterioration curve can be used to generate a warning

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signal to the system operator and as a tool for product service recommendations (CL1, Lines 15-18). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the system of **KA**, **CR**, **EN** and **BU** with the system of **WA** that included the statistical analysis script generating an estimated deterioration rate curve for the subset of compartments of the product, as the deterioration curve could be used to generate a warning signal to the system operator and as a tool for product service recommendations.

Per Claim 19: **KA**, **CR**, **EN** and **WA** do not expressly teach that the performance deterioration rate analyzer further comprises a transformer that transforms each estimated deterioration rate curve for a compartment to a performance life distribution. **BU** teaches that the performance deterioration rate analyzer further comprises a transformer that transforms each estimated deterioration rate curve for a compartment to a performance life distribution (Pg 321, CL 1, Para 5 to CL2, Para1), as the performance life distribution can be used to predict how long the system can operate safely and to optimize preventive maintenance programs (Pg 321, CL2, Para 1 & 2). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the system of **KA**, **CR**, **EN** and **WA** with the system of **BU** that included the performance deterioration rate analyzer further comprising a transformer that transformed each estimated deterioration rate curve for a compartment to a performance life distribution, as the performance life distribution could be used to predict how long the system could operate safely and to optimize preventive maintenance programs.

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16.2 As per Claims 38, 39, 58, 59, 78 and 79, these are rejected based on the same reasoning as Claims 18 and 19, supra. Claims 38, 39, 58, 59, 78 and 79 are system, method and computer readable medium claims reciting the same limitations as Claims 18 and 19, as taught throughout by **KA, CR, EN, BU** and **WA**.

17. Claims 20, 40, 60 and 80 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Kaminskiy et al. (KA)** ("A Monte Carlo approach to Warranty Repair predictions", SAE International, 1997) in view of **Cribbes (CR)** ("Changes in Engine maintenance management", Aerospace Engineering, December 1997), and further in view of **Endrenyi et al. (EN)** (IEEE, 1997), **Butler (BU)** ("An expert system based Framework for an incipient failure detection and Preventive maintenance system, IEEE 1996), **Wang (WA)** (U.S. Patent 6,230,095) and **Moosa et al. (MO)** (U.S. Patent 5,822,218).

17.1 As per Claim 20, **KA, CR, EN, BU** and **WA** teach the system of Claim 19. **KA, CR, EN, BU** and **WA** do not expressly teach that the simulator uses the performance life distributions to determine a Weibull distribution for a subset of the plurality of compartments defined for the product. **MO** teaches that the simulator uses the performance life distributions to determine a Weibull distribution for a subset of the plurality of compartments defined for the product (CL4, L56-67), as the Weibull distribution is sensitive to the distribution shape parameter at the extremities of the distribution and extrapolations can be made based on the properties of the distribution (CL4, L56-67; CL17, L36-41). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the system of **KA, CR, EN, BU** and **WA**



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with the system of **MO** that included the simulator using the performance life distributions to determine a Weibull distribution for a subset of the plurality of compartments defined for the product, as the Weibull distribution is sensitive to the distribution shape parameter at the extremities of the distribution and extrapolations could be made based on the properties of the distribution.

17.2 As per Claims 40, 60 and 80, these are rejected based on the same reasoning as Claim 20, supra. Claims 40, 60 and 80 are system, method and computer readable medium claims reciting the same limitations as Claim 20, as taught throughout by **KA, CR, EN, BU, WA and MO**.

### ***Conclusion***

18. The prior art made of record and not relied upon is considered pertinent to the Applicants' disclosure.

The following patents and papers are cited to further show the state of the art at the time of Applicants' invention with respect to Service prediction using performance and service information and simulation models.

1. Moore, "Apparatus and method for monitoring and maintaining mechanized equipment", U.S. Patent 6,370,454, April 2002.
2. March, "Method and apparatus for monitoring hydroelectric facility maintenance ...", U.S. Patent 6,490,506, December 2002.

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3. Hedeem et al., "Locomotive diagnostic system", U.S. Patent 6,377,876, April 2002.
4. Richer, "Engine monitoring display for maintenance management", U.S. Patent 6,408,258, June 2002.
5. Okogbaa et al., "Time series intervention analysis for Preventive/ Predictive maintenance management of multiunit systems", IEEE 1998.

19. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Kandasamy Thangavelu whose telephone number is 703-305-0043. The examiner can normally be reached on Monday through Friday from 8:00 AM to 5:30 PM.

If attempts to reach examiner by telephone are unsuccessful, the examiner's supervisor, Kevin Teska, can be reached on (703) 305-9704. The fax phone number for the organization where this application or proceeding is assigned is 703-746-7329.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-9600.

K. Thangavelu  
Art Unit 2123  
September 19, 2003

  
**SAMUEL BRODA, ESQ.**  
**PRIMARY EXAMINER**